REVIEWS.

ART. XIV.—*Experimental and Practical Researches on the Structure and Function of Blood Corpuscles; on Inflammation, and on the Origin and Nature of Tubercles in the Lungs.* By WILLIAM ADDISON, F.L.S. (Transactions of Provincial Medical and Surgical Association, Vol. XI. p. 233.) London, 1843.

The Actual Process of Nutrition in the Living Structure demonstrated by the Microscope; and the Renewal of the Tissues and the Secretions from the Blood thereby illustrated. By WILLIAM ADDISON, F. L. S. (Transactions of the Provincial Medical and Surgical Association, Vol. XII. p. 235.) 1844.

On Healthy and Diseased Structure, and the True Principles of Treatment for the Cure of Disease, especially Consumption and Scrofula; founded on Microscopical Analysis. By WILLIAM ADDISON, M. D., F. R. S., Licentiate of the Royal College of Physicians. 8vo. pp. 320. London: Churchill, 1849.

THE employment of the microscope in the study of general anatomy and physiology, has not only subverted previous classifications, by enlarging our acquaintance with these branches of medicine, but has greatly modified our knowledge of various pathological processes. This result has been accomplished in two ways, viz.: by direct observation, and by inference. All that is positively known to be true, has been acquired by the former means; much that is merely plausible or really false, by the latter. Microscopy is eminently a science of observation; the information it affords does not differ in kind from that we receive through the eye alone, and its province is not to take the place of, but to assist the sight. Now, with the eye, the size, form, colour, and grouping of bodies are recognized; and, if anything more be known, it is by means of comparison with previously ascertained facts of the same sort, or with the subjects of the other senses. The best lens cannot reveal to us more of the constitution of matter than the above-enumerated qualities, as they are seen in its minute particles; their origin, transformations, and destination, are not objects of sight. If an additional reason were necessary, why we cannot study the changes taking place in microscopic elements, it would be apparent from the reflection, that nearly all microscopic observations are made upon matter withdrawn from the sphere of vital influences, and, even where it is possible to inspect parts still preserving their connection with the living animal, the magnifying power used is necessarily so low as to preclude the minute investigation which is obviously required. It is true that, by the employment of chemical substances, or of water alone, certain changes will take place in the elementary composition of the fluids submitted to inspection, and the phenomena so produced may simulate the natural transformations; but there can be no doubt that a spontaneous vital metamorphosis or growth of a cell-organism has not yet been really seen.

We may examine the constituent cells and granules of pus, or tubercle, or cancer, and it is possible that, at some future period, a unanimity of opinion may prevail among microscopists, as to their characteristic elements; the presence of abnormal particles in the urine, the saliva, mucus, and other secretions, may be detected; but the spontaneous changes of a single pus, cancer, or tubercle cell, or the development of a solitary crystal in the organic fluids has not yet been observed by any microscopist. This fact, we would repeat, is not due to the imperfection of our instruments, but to the imperfection of all observation. It appears to us of the greatest importance that the real province of the microscope should be kept constantly in mind, and that we should be able to determine where observation ends and inference begins. For it is owing to the want of this discrimination, that some of the greatest errors have been introduced into microscopic anatomy. The number of microscopic observers is, comparatively speaking, so small, that we are deprived of those safeguards against the propagation of error, which, in other branches of medical investigation, are provided by the simultaneous labour of numerous individuals. And since, also, it is much easier to propagate errors than to eradicate them, the evil tendencies of the neglect of this precaution, remain for a long time unchecked. Hence it is that the microscope has fallen into discredit with many; hence the conflicting opinions, the contradictory statements, the irreconcilable theories which obscure the truth in this department of science. If we had now a record of all that microscopists have really seen, separated from their conjectures and assumptions, we should possess therein a fund of positive knowledge of inestimable value, in the further prosecution of similar researches, but, in its present condition, the microscopic history of morbid products is a perplexing labyrinth.

Henle has remarked, that it is not correct to attribute the errors of microscopists to the optical illusions which sometimes may mislead them; but that the fault more frequently lies in the incorrect interpretation of that which is correctly seen. If, for instance, fibres be seen upon the field of the microscope, and they are assumed to be of a muscular character; or, if the molecular movements in liquids be taken as evidence of the inherent vitality of the particles under examination, the error does not arise from the object not having been seen aright, but from its being wrongly explained. The judgment is in fault, although the eye has not been deceived. It is not our purpose to illustrate the remarks above made by a reference to the present condition of microscopic anatomy and physiology, but, as they have been suggested to us by the treatises which stand at the head of this article, it is in them that we propose to look for examples of the fatal effects which ensue from the forgetfulness of true principles. Müller (*Physiology*, Am. ed. p. 469) has very correctly said, "The process of nutrition is not an object of microscopic observation." Dr. Addison, on the other hand, proposes to demonstrate a "microscopical theory of nutrition," and he anticipates "that the science of medicine is to be hereby established upon a surer and more philosophical foundation, in consequence of which, we shall be enabled to extend our remedies, and suggest new physiological methods of treatment for the maladies of mankind." The anatomical lesions of consumption and scrofula, as well as incidentally of other diseases, it is the object of this theory to explain; together with the causes, symptoms, and treatment of the above-mentioned maladies. It will appear further, what success this endeavour has met with; but we must first follow Dr. Addison, in the observations upon which his theory purports to rest.

In this system of nutrition, the principal part is played by the lymph, or colourless corpuscles of the blood; indeed, these bodies seem to have attracted Dr. Addison's attention, to the exclusion of its remaining constituents. They are not only concerned in the nutritive process, but are the sole agents by whose instrumentality it is conducted, and as inflammation is regarded by our author as merely an exaggerated nutrition, the metamorphoses which they undergo, determine its character and duration. Dr. Addison's object is, to demonstrate the proposition, "that all the textures of the body arise from the metamorphosis of cell-organisms in the embryo; that they are nourished by the metamorphosis of cell-organisms in the blood; and are displaced, interrupted, or go back again to cell-organisms, in scrofulous disease, phthisis, and ulceration." The doctrine of the formation of the tissues directly by the blood-globules was first proposed by Doellinger, but received assent only from a very few of his cotemporaries and followers. No one has, since his time, been able to confirm his observations, and we are hence warranted in the supposition, that his error was due, either to the imperfection of his microscope, or to that desire to introduce a new and startling theory, which has always been productive of so much mischief in retarding the real progress of medical knowledge. In our own time, however, it may be said that Dr. Martin Barry has advanced essentially the same doctrine. (*Philos. Trans.*, 1841, 2, 3.) He states that the blood-globules of mammalia not only have *nuclei* (which we may be allowed to remark is in direct contradiction with the statements of Gulliver, Wagner, Owen, Donné, Henle, Vogel, and Duckett), but that the nuclei contain, coiled up in a disk, filaments which have the faculty of unwinding to form fibres, and thus contribute to the formation of the tissues.

We allude to the similarity between the opinions of Dr. Barry and those of our author, merely for the sake of calling attention, at the same time, to their disagreement upon the comparative importance of the red and the white corpuscles of the blood in the scale of organization, and in the process of nutrition. While Dr. Barry attributes all the processes described by him to the *coloured* globules, which he regards as derived originally from the colourless, or "parent cells," Dr. Addison, on the other hand, holds that the latter are more "complexly organized," and are higher in the scale of development than the former; and he looks upon them as the foundation of the tissues, and the "special secreting cell." He says: "The *colourless* corpuscles of the blood are very highly organized cells, within which the special tissues and secretions are elaborated; and it appears that the renovation of these tissues and secretions from the blood does not take place by the cells discharging their contents into the general mass of the circulating current, to be separated therefrom by some peculiar transcendental and hypothetical selective process of exudation, through a structureless and transparent tissue, but by being themselves attached to, incorporated with, and performing their special function in the structure." (*Trans. of Prov. Med. and Surg. Associa.*, xii. 261.) It would naturally be expected that the number of colourless corpuscles should bear some proportion to the numerous and important functions which, according to the above extract, they are destined to fulfil. Now their number in the blood is so trifling, compared with the red globules, that they have very often been altogether disregarded by microscopists. Dr. Addison says, however, that they are very numerous in vessels actively engaged in nutrition, and although it is not apparent by what mark such vessels are to be distinguished from others, we are willing to grant that, under certain circumstances, their number may become augmented. Dr. Addison further states (*loc. cit.*, xii. 260), that he has seen them fibrillating so as to form the walls of the vessels; that they adhere to and become imbedded in them first, and contribute, with the filaments which result, to the formation of the tissues. It is at this point that we look anxiously, but in vain, for the demonstration of the manner in which these bodies, whole or disintegrated, become part of the living texture. We hoped that Dr. Addison had succeeded in tracing them further in their progress, had seen them reappear on the outside of the vessels, and devote themselves to the functions he has assigned them. But he has not been able to do more than his predecessors, and we are obliged to be content with an experiment which we find termed a "*glaring instance*" of a compact, tough, elastic, colourless, and fibrous tissue, forming from the colourless elements of the blood; the several stages of its formation being "actually seen and determined." He says (*loc. cit.*, xii. p. 244): "if blood be drawn from a person with rheumatic fever, and a drop of the *liquor sanguinis*, before coagulation, be placed on three slips of glass, at intervals of thirty or forty seconds, and then examined with the microscope, the first will exhibit colourless blood-corpuscles in various conditions, and numerous minute molecules distributed through a more or less copious fibrous network; and the last will show a tough, coherent, and very elastic membrane, which cannot be broken to pieces, or resolved into smaller fragments, however roughly or strongly the two pieces of glass be made to rub against each other." In a second experiment, the corpuscles, *after the addition of a drop of water, or of liquor potassæ*, were seen to rupture and discharge their contents, leaving molecules, granules, and filaments, upon the field. In like manner, the formation of the buffy coat of inflammatory blood, is explained upon the supposition that the colourless blood-corpuscles, which, in inflammatory diseases, are found to become more numerous, rupture from the sudden change of temperature, or from other causes, and discharge their contents, consisting of liquor sanguinis and molecules; the liquor sanguinis then rises, drawing with it the molecules and corpuscles not yet ruptured, and fibrillates "as it would have done in the living vessels, had the contents of the corpuscles been appropriated to the purposes of nutrition."

It may justly be inferred from the foregoing extracts, that our author holds the opinion, that the coagulation of blood removed from the body, represents the process of fibrillation, or the formation of fibrous tissues within it, and that, in both instances, the changes which take place are due to the disintegration of the colourless corpuscles of the blood. We will not repeat here the objections which have been already made to the endeavours to establish a theory in any other way than by direct demonstration; but the argument before us is not unlikely to mislead some, under the idea that the point in question has been actually demonstrated. There is, however, no parallelism between the phenomena which Dr. Addison endeavours to assimilate; for manifestly, the changes which take place in blood, after being removed from the vessels and left undisturbed to the operation of physical laws, cannot be brought into comparison with the vital processes which are constantly in play in the living body. These phenomena are assumed to be similar, because, in the experiments above given, a so-called "membrane, tough and elastic," was formed. However much the buffy coat may resemble an "elastic fibrous tissue" under the microscope, it certainly presents no such appearance to the unassisted eye, and, in the rapidity of its formation, is very unlike the normal membranes of the living body. In fact, these experiments bring Dr. Addison somewhat into contradiction with himself; for, when assigning a reason why the nutritive process, as described by him, cannot be seen in the irritated web of a frog's foot, he says that the changes are, in this example, too *slow* to be followed; that the corpuscles go on congregating in the irritated tissue for an hour or two, but that, "if the part were patiently watched for a sufficient length of time, *it is very possible* that still more of the process might be seen." Yet so expeditious is the nutritive process *outside* of the body, that we have, in coagulated fibrin, "a glaring instance of a compact, tough, elastic, colourless and fibrous tissue, forming from the colourless elements of the blood," in a few minutes.

Moreover, much of the novelty attaching to Dr. Addison's theory of the exclusive function of the colourless corpuscles in nutrition is lost, by his declaration that they contain the *liquor sanguinis* and become instrumental in promoting the growth of the tissues only by their rupture and the discharge of their contents. Now, according to the general belief of physiologists,—in opposition to which there are no objections, and which cannot at least be disproved, if it cannot be demonstrated,—the body is nourished out of the plasma of the blood, or the *liquor sanguinis*, which transudes the walls of the capillary vessels, and the various secretions are formed and elaborated by the organs, in conformity with laws whose operation it is not in the power either of chemistry or the microscope to unravel. But Dr. Addison creates for himself very unnecessary difficulties, by enclosing the *liquor sanguinis* within the corpuscles and thus rendering its escape from the vessels impossible. And indeed, he goes even further than this, for notwithstanding the comparatively small number of colourless corpuscles in the blood, he says (*loc. cit.*, xii. p. 248), "Neither the fibrinous element nor the serum circulates in the blood as part of the fluid in which the red corpuscles are suspended in the living vessels; they are both enclosed within, and form, incorporated together, an essential ingredient of the interior contents of the colourless corpuscle." What, then, it may be asked, is the nature of the liquid in which the corpuscles move when in the living vessels? It is impossible to determine; for it cannot be procured for experimental examination, without being mingled with corpuscles; nor, according to these views, without some of them bursting and mingling with it their own contents. Perhaps no better instance than the above could be found, by which to exemplify the indifference to consequences which the zealous theorist entertains. It would seem that a moment's reflection would render the untenable nature of the above proposition so manifest, that it is a matter of great surprise to us, how it could ever have been seriously advanced, for it not only has no facts to sustain it, but is intrinsically absurd. For, as the blood is constituted of the corpuscles and the *liquor sanguinis*, and the latter of water, holding fibrine, albumen, and numerous salts in solution, if it were possible to separate the fibrine and albumen from the other elements, and enclose them within the colourless corpuscles of the blood, we would have two fluids of different densities separated from each other by the delicate coat of the corpuscles. The necessary consequences of this condition of things would be, that an interchange of elements would immediately commence, according to the laws of endosmosis and exosmosis, and the contents of the globules, and the liquid in which they swam, would very soon acquire the same specific gravity.

The views entertained by Dr. Addison, of the constitution of mucus and pus, deserve notice here, as forming an essential part of his theory of nutrition. In the outset, mucus is supposed to bear a remarkable analogy to the liquor sanguinis at the surface of buffy blood. (*Loc. cit.*, p. 248.) The latter "is a plastic fluid, containing numerous molecules and colourless blood-corpuscles; and when the fluid fibrillates, it incorporates the molecules and unruptured corpuscles, forming tissue." The former "is a glairy, semi-fluid tissue, containing numerous molecules and colourless mucous globules; mucus frequently exhibits a copious and distinctly fibrous character or structure, and always does so when a *little dilute acid* is added to it, an addition which cannot form the fibres." An experiment was made upon some mucus from the nose; it became whitened by the addition of a drop of dilute acetic acid, and "its fibrous structure was rendered very evident." A drop of healthy pus, when mixed with liquid potassa, lost its opaque character, and became clear, transparent, and tenacious, resembling mucus, an appearance which was found to be owing to the rupture of the corpuscles; but, upon the addition of a little dilute acetic acid, it resumed somewhat of its former white aspect, and being pressed into a thin film, under the microscope, showed "as copious a fibrous structure or character as the fibrillated liquor sanguinis."

These experiments, Dr. Addison thinks, set at rest the question of the difference between pus and mucus, prove the identity of mucus and pus globules, and show them to have a common origin in the colourless corpuscles of the blood. It does not appear to us, that our author is warranted in the inferences which he deduces from these experiments. It is hardly allowable to claim identity of character for two organic products, on the ground that they may be brought to resemble each other in one property, by the application of chemical reagents, whose mode of action upon them is unknown; and much less that any argument for their common origin can be drawn therefrom. The acknowledged difficulty of distinguishing the mucous from the pus globule, under the microscope, has never before, as far as we are aware, been made a ground for assuming them to be identical; for if this were to be made a test of the character of microscopic objects, it would be just as correct to assume all primitive cells to be similar in nature, because they happen to be so in appearance. The actual constitution of granules, nuclei, and cells, is not ascertainable by these means, and the employment of chemical substances to disintegrate or alter them in any way, so far from elucidating their nature, serves only to render the solution of the problem more difficult. Moreover, a candid investigation of the actual relations of mucus and pus would seem to require, that the inquiry should not be restricted within one method of observation, but that they should be carefully compared with the results and facts already known. In this manner many facts, obtained by microscopic observation, have been confirmed, and their real truth and importance established. But, in this case, we find, that our previous knowledge conflicts seriously with the inferences which Dr. Addison would draw from his observations. Mucus is a normal secretion, peculiar to certain membranes of the body, when in the healthy condition; while pus, on the other hand, is the product of disease. We do not find the former replacing the latter, except in those membranes whose province is to secrete it, and only after the inflammatory condition has entirely ceased. Nor do we see pus replace mucus, unless inflammation first takes place. For inflammation is evidently not an exaggeration of the nutritive process, and the difference between its products and mucus is merely quantitative, since it is precisely during its continuance that normal nutrition is suspended; the increase in bulk which occurs in inflamed parts being due to effusion of blood-plasma into the tissues, and not to an increased development of the elements of the tissue which would constitute a true hypertrophy. Hence, if mucus, which is a normal secretion, does not represent an earlier stage of pus, which is the result of inflammation, a fortuitous resemblance of its microscopic elements to those of pus can hardly be looked upon as sufficient reason for the rejection of the evidence of our senses and previous knowledge; nor can we conclude with Dr. Addison, that the chief distinction between mucus and pus arises from the number of unbroken cells in the latter, with imperfectly elaborated contents, while the peculiarity of mucus and other healthy secretions is due to the disintegration or opening of the cell, and the discharge of its contents. We may add, that Dr. Addison is not supported in his views of the identity of the microscopical elements of these secretions by other observers. Hodgkin, Vogel, Valentin, Guterböck, Henle, and many others of equal authority, have been content to own the difficulty of laying down any fixed character as peculiar to either of these products; the inferences which Dr. Addison has considered himself warranted in drawing, are peculiar to him, and have been neither suggested nor confirmed by any other microscopist, although several years have passed since their first publication.

The objections which we have made to the explanation of the processes of nutrition and secretion, by a description of the changes which are supposed to take place in the coagulation of blood, and to the mode of determining the relations of pus and mucus, have involved, for the time, a tacit concession of the truth of an assumption, which still remains to be proved. This is, the passage of the *colourless* blood-corpuscles through the walls of the vessels. The *red* globules, although smaller than the others, have not the same faculty granted to them. This passage is, according to our author, the first step in the process of nutrition, and we may add that, without it is fully demonstrated, the whole system falls of itself to the ground. It is incumbent upon Dr. Addison to demonstrate it, if he would invite belief in the propositions advanced by him; and, until this were done, we might very well dispense with any examination into its correctness. But Dr. Addison owns his inability to prove the passage of any of the blood-corpuscles through the vessels, and that he has not actually seen it; yet, at the same time, he says (*loc. cit.*, xii. p. 264), "In normal nutrition, they adhere to the tissue forming the boundary of the blood-channels; they *pass into* and contribute to form the tissue, and are afterwards evolved or thrown off from the nearest surface, a follicle, crypt, or duct, constituting epithelial cells;" also, "the facts contained in these researches, with others, which have for some time been accumulating from other sources, are quite incompatible with the doctrine, that all the blood-vessels have *permanent tubular coats.*" It will be at once seen, that the establishment of this fact would be fatal to Dr. Addison's theory; but few will be found to assent to such an inversion of all principles of induction as that, because facts will not support a theory, they may be disregarded in order that it may stand. An incompatibility of facts with opinions, is a singular argument for the validity of the latter.

If it be proved that the capillary vessels are provided with independent walls, it is clearly impossible that bodies of the diameter of the blood-corpuscles, whether red or white, can pass through them; for it is well known that some of these vessels are so exceedingly minute, that it has been a matter of doubt whether the blood-globules circulated through them at all, for which reason they received the name of *vasa serosa.* Their area was found to be too small to permit the passage of the corpuscles, and it has since been discovered that it is only by means of their elasticity that these bodies, in elongating themselves, can penetrate them. This being the case, how is it possible to suppose that corpuscles with a diameter of $\frac{1}{2000}$ to $\frac{1}{500}$ of a line, can get through their interstices, which cannot of course compare with the diameter of the vessel itself. Dr. Addison has divided the capillary vessels into two classes, the fibrous and the corpuscular, with some of a mixed character between the two; the first are found chiefly in the serous membranes, the others in those organs or structures which are termed corpuscular. This we are to understand as "expressive of the soft, friable, parenchymatous texture formed of elaborating cell-organisms, the term cellular being limited to those which are coherent, non-elaborating, and elastic;" the liver, brain, and intestinal villi are examples of the one, the lung is a specimen of the other. By a "corpuscular capillary" is meant one that is "bounded by the special elements of the texture, having walls consisting of cell-organisms." In other words, there are capillaries which have walls of their own, and there are others which have none, but are merely channels in the tissue. Yet the process of nutrition is, according to Dr. Addison, accomplished by the transit of the corpuscles through the coats of the vessels, and, we would add, that it is apparently conducted in the same manner in all parts of the body. Hence, those structures which are not provided with the corpuscular capillaries, are entirely cut off from any means of nourishment and growth. If we turn, however, to the works of other physiologists who have examined this point, we will find nothing to substantiate the theory which Dr. Addison endeavours to maintain. Henle (*Allgemeine Anatomie*, S. 537) says that, apart from the reasons we have, from observation of the steadiness of the current, to believe that the capillaries are not merely channels in the tissue, the existence of independent walls has been proved by the complete separation of the capillary network from the parenchyma by maceration. This fact has been demonstrated by Windschman, in the plicated organ of the cochlea of the ear in birds; by Müller, in the cortical substance of the kidney of the squirrel; by Valentin, in the villi of the small intestine, and by Schultz, in the plexus choroides of the brain. Treviranus isolated the capillaries of the brain, and describes their tunic as being of an homogeneous structure. Berres (*Anatom. Microscop.*, Viennæ, 1837), in his great work upon the microscopic anatomy of the capillaries, has demonstrated that they are disposed in the various organs of the body, according to a system which is, in similar organs, constantly uniform and peculiar; and he says, further, that they all possess an independent membranous wall, which he terms the "*membrana polita s. glabra.*"

Wagner (*Physiology*, p. 288), in like manner, avers that the finest vessels have always distinct parietes, constituted of a simple membrane of great tenacity, and generally structureless, and that even circular fibres are discernible in those of $\frac{1}{500}$ to $\frac{1}{1000}$ of a line in diameter. Schwann also describes these circular fibres in the capillaries of the mesenteric vessels of the frog. Hyrtl (*Handbuch der Anat.*, S. 94) says that the finest capillaries, viz. of $\frac{1}{2000}$ of a Viennese line in diameter, possess a simple structureless coat. This, he adds, is so thin and transparent, that, in the living structure, it can be seen only by means of the blood circulating through it, and that it is permeable only for the fluid constituents of the blood. Bischoff (*Entwickelungs Geschichte*, S. 273), in his observations upon the embryos of frogs and fishes, has often observed that, in a capillary loop, the walls of which are visible, not a single corpuscle will, for some time, pass. Suddenly, however, one will enter from the neighbouring vessel, and be soon followed by others. This circumstance, he remarks, may very easily give rise to illusions with regard to the existence of independent walls to the capillary vessels. Direct and demonstrative proof, like that which is here cited, must outweigh a volume of negations; for, as we have seen, Dr. Addison brings no evidence, drawn from observation, in support of this part of his theory. We might, indeed, have declined adducing testimony in favour of what has good claim to be considered an established fact, until proof of the same nature had been produced in opposition to it; but, in view of the plausibility of the system of nutrition advanced by our author, it seemed proper to place a brief sketch of the actual state of physiological knowledge on this point before those who might be otherwise misled.

The last work of Dr. Addison contains the further development of his system of nutrition, and its application to the pathology of consumption and scrofula. It is divided into chapters, which are termed respectively, Practical Physiology, Pathology, Psychology, and the Symptoms, Causes, and Therapeutics of Consumption. It would require a far more extended notice than we think warranted by the nature of its contents, should we undertake an analysis of this volume. The disregard with which the observations of the most eminent authorities are passed by, except when they happen to coincide with our author's views, would be of itself a sufficient cause to awaken distrust in the mind of any impartial student. But it is the remarkable fallaciousness of the reasoning, which is the prominent characteristic of this work. It may be called bold, and, by the superficial reader, plausible, but we think that, had it emanated from any one of less authority than Dr. Addison, it might be characterized in less equivocal terms. That portion of the work devoted to the therapeutics of consumption and scrofula, contains, as might be expected, little of novelty for the practical physician. The details of cases, given in the language of patients of evident refinement, although occupying more space than is usually allotted in scientific treatises to such communications, are very readable and interesting. In the chapter upon the etiology of consumption, there is a fair specimen of the mode of reasoning in which Dr. Addison seems to excel; we refer those who may wish to discover the reasons for believing "*atelectasis pulmonum*" to be the principal cause of consumption, to examine for themselves, as the argument by which this doctrine is supported does not appear to us to be susceptible of analysis.

We have, however, a few words to say of Dr. Addison's pathology, in a more general sense. For him, the usual division of diseased products into homologous and heterologous, has no existence; tubercle is not anything different from the normal structure of the human body. Inflammation and tuberculization are merely different stages or phases of one process; the material effused in pneumonia does not differ from tubercular infiltration, except in its being absorbed (page 52), or becoming capable of absorption; and a hepatized lobule may not be distinguished from a semi-transparent granulation, except that the one is recoverable and the other is not. The whole system rests upon the "conformable" or "unconformable" changes of cells (*i. e.*, the colourless blood-corpuscles). The natural order, according to which the tissues are developed, is from cells to fibres, cartilage, and bone. The first represent the "embryonic," or corpuscular structure, the latter, the adult or fully formed structure. If, now, the elements characteristic of the embryonic structure appear among, and take the place of those more fully advanced in the scale of development, disease is the result, or rather those forms of disease which Dr. Addison has chiefly in view, viz. consumption and scrofula. For example; if a bone be broken, and from the elements first effused after the injury callus is formed, and subsequently new osseous matter deposited, the new elements conform in all respects to the law of the texture, and the result is a cure. If, however, the "morphology" be unconformable, the nutritive matter effused does not undergo the necessary transformations, and the fracture remains ununited; for, by the words "unconformable morphology," we are to understand, an indisposition upon the part of the cells, with their plastic contents, to resolve themselves into fibres, cartilage, and bone. But it is not easy to see what real explanation of a morbid process this can be. For, if a fractured bone does not unite, nor a wound heal, it is, perhaps, not incorrect to say, that the morphology is unconformable, but it is no explanation *why* the reparative process does not take place. The use of these words is, therefore, only suited to lead the unobservant to believe that they know thereby more of the condition of the parts in question than they did before. It is, moreover, a matter of surprise that Dr. Addison should have fallen into so common an error, when he subsequently, in another place (page 74), himself stamps it with its true character; he says (page 33), "We frequently see children falling away without evident cause, and we have found parents quite satisfied when told it is an atrophy—an expression conveying not one whit more information, either to the physician or the patient, than what is known to every casual observer."

The so-called "retrograde metamorphosis" forms, however, a more essential portion of our author's pathology. "Villi, papillæ, follicles, and granulations are," he says, "characteristic of the mucous tissue." "In the embryo, all tissues being corpuscular, it is some time before any distinction between mucous and serous textures exists." "In the adult serous and fibrous textures, there are no granulations, villi, or follicles, as in the mucous membranes; but, when they are attacked by inflammation or scrofulous disease, they assume a granulation or villous state, concomitantly with a change in the elements of the walls of the vessels from simple fibres to cell-organisms. This is a retrograde metamorphosis—a condition analogous to the embryonic state." (Page 35.) It is possibly true, notwithstanding recent investigations have thrown doubt upon the fact, that the corpuscular tissue lies at the basis of all others, or, in other words, that nerve, fibre, bone, and every organized tissue, are originally derived from a cell. In this sense, it may be justly termed an embryonic structure, if we first clearly understand that a corpuscular and a mucous tissue are not necessarily one and the same, as Dr. Addison inculcates; for it does not by any means follow that, because mucous membranes are mainly corpuscular in their arrangement, therefore all tissues of a corpuscular character are mucous tissues. In the adult, the mucous membrane is as much a permanent and perfect tissue as is any other; and, if it may be called embryonic in any sense, it certainly cannot be in that of its being imperfect, for, in the words of our author, "the corpuscular textures hold a higher rank, have more activity than the fibrous, the mucous than the serous" (page 38); and yet, with singular inconsistency, the appearance of this texture among fibrous structures is termed a *retrograde* metamorphosis. We are told that, "in consumption and scrofulous disease, cell-organisms, characteristic of the embryonic structure, and of blood, reappear amongst and supplant the elements characteristic of the healthy adult texture;" and again, "retrograde metamorphosis occurs when the form and qualities of a texture are completely changed by the intrusion of elements distinctive of a *prior or lower* type." (Page 20.)

Dr. Addison quotes the observations of Guillot, and of Schrœder Vanderkolk, in reference to the supplementary circulation in tuberculous lungs; but with the exception of a coincidence in the employment of certain words, it is difficult to see what support the peculiar pathological system under discussion can derive from them. The tufts of new vessels, seen upon the walls of a tuberculous cavity, present, when viewed by a common lens, a "sort of villous structure," and there is a vascular network surrounding these cavities and connected with the aortic system. The authors above named, make use of the word *villi* only as a means of illustration, whereas Dr. Addison understands thereby all structures of an embryonic character, or imperfect in development. They, as well as all other writers, speak of semi-transparent granulations as an early stage of tubercle; but in Dr. Addison's work, "granulation" is but one of several terms by which structures composed of "cell-organisms" are designated. It is from the similarity of their elementary or microscopic composition, that our author considers himself entitled to make use of them as convertible terms, and to confound the granulations of a healing wound and the villi of a mucous surface with the products of tubercular disease. Dr. Addison says that his post-mortem examinations establish the facts, "that the growth of corpuscular granulations or villi, in the serous and fibrous textures, is the primary change; the transformation of these granulations into opaque tubercles or tuberculous matter is the next, and the retrogradation of the natural textures surrounding the tubercles are the essential phenomena of consumption, the indispensable anatomical change of phthisis." (Page 63.) "It would appear," he also states, "from the frequently stationary character of pulmonary tubercles, from the absence of any active nutritive function in the texture around them, from their degenerated structure and want of vascularity, that they are blighted granulations." Now we would ask, what resemblance does the tubercular granulation, which is a semi-transparent, unorganized morbid product, bear in its origin, course, or destination, or in its pathological significance, with the vascular, secreting granulation of a healthy surface, or of an ulcerating wound? None, except in its granular form and in its microscopical characters; cells entire or fragmentary being found in both. If its form be a sufficient reason, the miliary tubercle might as well be termed a millet-seed, as a granulation; and with regard to its microscopical characters, it is very certain that no one can be justified in assuming the presence of microscopic cells, in structure and products otherwise totally dissimilar, as indicative of a common origin, or a common character. We are at a loss, also, to understand what can be meant by a blighted granulation! The reasons assigned as warranting the use of this appellation in the case of tubercle, might with equal justice be applied to any other stationary morbid product or tumour. A lipoma, a simple fibrous, or an encysted gelatinous tumour, or a scirrhous deposit, might likewise be said to be composed of blighted granulations, on account of the absence of nutritive energy in the surrounding texture, their degenerate structure, and want of vascularity.

We have endeavoured, as far as was consistent with the necessarily limited space of this article, to place fairly before our readers Dr. Addison's theory, and the observations and hypotheses upon which it rests. The comments we have made upon it, have sprung from our disagreement with the author upon the principles necessary for the establishment of truths in this interesting department of medical science, as well as from our conviction of the fallaciousness of the reasoning by which he seeks to maintain his positions. We would not conceal our admiration of the eloquent and attractive style in which this new system of nutrition is put forth, nor deny that it is illuminated by a brilliant fancy and pervaded by a strong religious feeling; yet it is but too evident, that it owes to these very merits that plausibility, which, notwithstanding its radical defects, will recommend its adoption to the superficial reader. But the interests of medicine are now so closely linked with the progress of microscopic anatomy, that we cannot insist too strongly that the facts won by the microscope from fields before unvisited by observation should be real and not spurious, and that the rapidly advancing car of medical science should be turned from its headlong and erratic course, and conducted back into that only broad and safe highway which leads to the goal of truth.

M. S.